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Fiscal federalism in Western European and selected other countries: centralization or decentralization? What is better for economic growth?

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Contents

1 Introduction

For several reasons the process of decentralizing decisionmaking in the public sector has received much increased attention during the past decade: In some Western countries a reassessment of the existing system of fiscal relations among the different levels of government was demanded by certain regions (e.g. Canada, Germany), in the member countries of the European Union the debate intensified with regard to the functions the European Union should perform, in transition countries the breakup of centralized decisionmaking forced to establish new systems of fiscal federalism and in several developing countries fiscal federalism was discussed in particular with regard to its compatibility with macroecoonomic stabilization (e.g. Argentina, Brazil, India). However, despite this intense debate "systematic evidence on the contribution of fiscal decentralization to economic performance is scarce" (Oates, 1995, p. 352).

This paper attempts to contribute to this empirical research by looking at the experience of Western European countries where a wide variety of the degree of fiscal decentralization can be found. However, in an attempt to increase the robustness of the findings a sample of 17 Western European countries is enlarged by several other high income countries and several developing countries whose land size is relatively large.

The paper is organized as follows: section 2 provides a brief overview on the main theoretical arguments for and against fiscal decentralization. Section 3 outlines the growth framework used in this study and the applied estimation strategy. Section 4 presents and discusses the estimation results and section 5 concludes.

2 The case for and shortcomings of fiscal decentralization

Fiscal decentralization in this paper characterizes the (legal) power of subnational governments to raise tax revenues and decide on spending programs on their own will within legal criteria. It should be noted that there is no formalized theory of the relationship between fiscal decentralization and economic growth. This may reflect a basic conflict inherent in fiscal decentralization.

2.1 The case for fiscal decentralization

2.1.1 "Diversification hypothesis"

The "diversification hypothesis" (or "decentralization theorem") maintains that uniform levels of public goods and services across jurisdictions will generally be inefficient (Oates, 1972, 1977). The model that yields this result is based on two main observations: consumers' demand (preferences) for a given public good/service differ and public goods and services have different spatial characteristics, i.e. some benefit the whole country whereas others benefit only regions or local communities. It is assumed that
- a single public service is being offered,
- there are only two communities each of which has a different demand for the service,
- individuals are immobile,
- there are no economies of scale from centralized provision of the public service and
- there are no spill-over effects in the provision of the service from one community to the other.

In this model *a uniform level of public services offered in each community is inefficient* because in both communities due to the different demand schedules marginal benefits and marginal costs of the public service differ. Ressources can be saved without making somebody worse off by diversifying government outputs in accordance with local demands. Hence, Pareto efficiency can be raised through fiscal decentralization. In this model, the larger the

variance in people's demands for public goods the larger the benefits of decentralization tend to be. In other words, local government outputs need to be differentiated according to local tastes and circumstances but this requires discretion of local governments over spending programs, i.e. fiscal decentralization.

Introducing mobility of people into the Oates model causes incentives for individuals to move to that community that offers the best perceived combination of supply of the public service and local tax rate. Individuals would "vote with their feet" to join that community that offers them a preferred mix of taxes and public services. By so doing individuals contribute to efficient resource allocation. This is also the main thrust of the famous Tiebout (1956) model.

Besides increased efficiency through fiscal decentralization, the Oates model with mobility and the Tiebout model predict segregation of communities by income: assuming a positive income elasticity of the demands for local public services, the community with the higher per capita income will offer a higher level of public output per capita, all other things held equal. Given the larger tax base in this community, financing this relatively large level of per capita public output may not require a relatively high local tax rate. Hence, residents from the relatively poor community may wish to move to the relatively wealthy community in order to benefit from both the larger level of public output and larger tax base. Without a mechanism to prevent this, the model outcome is thus unstable. A stabilizing meachnism can be that high income communities employ, for instance, zoning regulations (such as prohibition of apartment buildings etc.) to fend off low income households. A tendency towards a system of relatively income-segregated communities results, who have specific preferences for public goods and services. Empirical studies for US-American cities confirm this stratification (e.g. Borjas, 1995) which is also visible at least in the large cities of most other countries.

The important point is that the outcome of this segregation of households by income class is efficient resource allocation in the local public sector. This finding has, however, serious qualifications:

First, the assumption of no spillover effects among communities (i.e. consumption of the public good is restricted to the individual community) is extremely restrictive. In the strict sense almost any local expenditure is associated with externalities even if there would be no mobility. For instance, local investment in health and education can be expected to result in more productive labor which promotes local economic growth and thus causes spillover effects. Moreover, if externalities increase over time, for instance due to technical progress, the case for decentralization may be weakened. Second, the model outcome of local differences in per capita quantity and quality of public goods/services will be in conflict with norms of social equity. This objection and the first one could, however, be alleviated through introducing transfers from the central government to subnational governments and prescribed minimum standards for the public goods[2]. Ideally, the transfer system should not cause new inefficiencies. Third, factors such as commuting costs and limited employment opportunities suggest that the model may better be applicable in a metropolitan context than in a regional one. Fourth, economies of scale in the production of public goods and services weaken the case for decentralization.

These qualifications show that there is a basic contradiction inherent in fiscal decentralization: Fiscal decentralization necessitates central government transfers and other measures of central government intervention to reduce inequities and other problems but this intervention erodes fiscal decentralization (Prud'homme, 1994, 1995).

Oates (1993) argued that the thrust of the basic case for fiscal decentralization (greater allocative efficiency) should also apply to a dynamic framework of economic growth. It could be expected that centrally determined policies consider regional and local conditions in the provision of public goods and services less well than locally determined policies, for instance regarding infrastructure and education. Economic development and growth may therefore be promoted if local authorities have a say in such policy decisions.

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[2] It may be possible to interpret the setting of norms of social equity as an explicit recognition of spillover effects (positive externalities) of certain public goods. Then the first and second qualification would not be different from each other.

2.1.2 "Leviathan restraint hypothesis"

Fiscal decentralization may act as a constraint on the behavior of revenue-maximizing governments (Brennan/Buchanan, 1980). To the extent that governments behave as revenue-maximizers, horizontal and vertical competition among different levels of government may contribute to containing the size of their budgets and thus restrain the overall size of the public sector. Fiscal decentralization may thus prevent an oversupply of public goods and services and/or x-inefficiency in the public sector.

2.1.3 "Productivity enhancement hypothesis"

Fiscal decentralization implies a transfer of responsibility associated with accountibility to subnational governments. This may provide incentives for subnational governments to not only consider local preferences of residents (as in the Oates model) but to search for innovations in the production and supply of public goods and services. Production costs and prices of public goods and services could thus be lower and their quality better than in a uniform approach to providing public goods and services. In addition, fiscal decentralization relieves the central government from many tasks. Thus, the latter may be able to better concentrate on efficient production of those public goods and services for whom it still bears responsibility (ideally goods and services with large spillovers among communities and/or substantial economies of scale in production).

2.1.4 Political arguments

Increasingly the economics literature acknowledges democracy as a factor of importance for long term economic growth. Political integration of minority groups, competition of governments, containment of vested interests, well defined property rights, transparancy in public transactions all tend to promote the development of markets and may better be guaranteed by a democratic than by an autocratic system.

For transition countries it has been shown that economic reform and democracy (proxied by the civil liberties index constructed by

Freedomhouse) are highly positively correlated (EBRD, 1999, p. 113). An empirical analysis of the political economy of reform in these countries does not support the traditional view that concentration of political power, limited political competition and even rapid implementation of reforms enhances the prospects for succesful and sustained economic reforms (EBRD 1999, chapter 5). This analysis argues that political competition and *less concentration of political power* promote economic reform by weakening the influence of vested interests on public policy.

These experiences demonstrate that a political strategy for economic growth should not be based on a simple model of a strong central government that may impose changes. Rather it may be hypothesized that fiscal decentralization strengthens democracy and contributes to economic growth: its political power diluting effect may weaken the power of interest groups; it promotes competition among subnational governments; it may have superior information channels because governments are closer to people; the closeness may also facilitate effective control of local governments; the ability of a country to produce ideas for innovations and implement them in the production of public goods and services may increase; ethnic and other minorities may not feel excluded from political power (especially in the local or regional context) which may reduce tensions in countries with regional ethnic diversities and thus stimulate economic activity.

2.2 Shortcomings of fiscal decentralization

The basic conflict inherent in fiscal decentralization is that it produces some clearcut failures which require central government intervention. The latter, in turn, erodes fiscal autonomy, responsibility and accountability of subnational governments. The theoretical case for fiscal decentralization is further weakened by problems of practical implementation.

2.2.1 Variance of incomes among households and regions produces inequities under fiscal decentralization

The Oates model showed that fiscal decentralization breeds social inequity: incomes and tax bases are unevenly distributed among jurisdictions and regions. Wealthier communities and regions are attempting to fend off low income households. Thus, there needs to be a centralized redistribution policy.

2.2.2 Macroeconomic stabilization

In order for a country to be able to smooth macroeconomic fluctuations it is necessary to at least reserve the option to intervene without a considerable time lag on a macroeconomic scale, especially through fiscal policy. However, for subnational governments there may be little incentives and/or possibilities to act countercyclically in a coordinated fashion and symmetrically with respect to recessions and booms[3]. Also, fiscal decentralization may change the income elasticities of revenues of the different government levels such that stabilization becomes more difficult. (If, for instance, the relatively income elastic and productive income tax and VAT revenues accrue to subnational governments, then the stabilization task for the central government may become more difficult). Hence, macroeconomic stabilization under fiscal decentralization may be inhibited because spending and revenue decisions of lower levels of government do not conform with stabilization goals.

As stressed by Tanzi (1995) the stabilization task in many countries (especially transition countries) refers not only to countercyclical goals but especially to fiscal adjustment needed to eliminate structural (chronic) fiscal imbalances. But structural imbalances may be worsened by fiscal decentralization: One example for this is when a government level grants a tax exemption regarding a tax whose

[3] It is generally agreed that the power of subnational governments to borrow should be strictly limited and that bail-outs of subnational governments by the central government should be prevented. Thus, the ability of subnational governments to pursue expansionary policy is limited.

revenue is largely received by other levels of government. Thus, tax sharing arrangements may cause perverse incentives.

Fiscal decentralization may contribute to predatory and unpredictable taxation (such as in Russia, see Zhuravskaya, 1999) which promotes shadow economic activity. Also effective and timely coordination among the different government levels may be difficult to implement, thus hindering stabilization.

2.2.3 Quality of governments and of local democracy

If on the central government level there is a lack of quality for whatever reason (e.g. lack of knowledge, corruption) that causes inefficiencies then decentralization could, in principle, be a remedy. However, it appears inconsistent to assume that local governments would be less affected by these problems. On the contrary, it may be argued that in general central governments achieve a higher quality level. They may attract the more qualified people because of better career opportunities and salaries (Prud'homme, 1994). In addition, local democracies may offer less effective control of elected officials than occurs at the central level, because officials at the local level are closer to people and therefore possibly more susceptible to personalism. If the quality of government declines with the level of government then decentralization could increase inefficiencies. If the quality at all government levels is very high, decentralization may not be needed, because the central government level may be able to collect and process quickly all information necessary to achieve those efficient outcomes that are expected from decentralization.

2.2.4 Low per capita income level

Decentralization implies fixed costs to run the subnational administrations and control them. In low income countries these fixed costs may consume a share of the total funds administered by subnational governments that is considered too large to justify decentralization (Prud'homme 1995). The contention that there appears to be some positive correlation between the income level and fiscal decentralization has also been made by Bahl and Linn (1992, p. 391-393): "Decentralization more likely comes with the

achievement of a higher stage of economic development". The authors argue that there is a relatively high treshold level of economic development at which fiscal decentralization becomes attractive. Such a threshold level can be explained not only with fixed costs of decentralization but with the fact that at a relatively low per capita income level, the demands for public goods and services may be concentrated on very few goods and have a small variance. Thus, at a low income level it may not be difficult for a central government to have all information necessary to make the right decisions on local public goods production. With a rising income level or starting at a certain minimum income level, the demands for public goods and services increase and so does their variance, i.e. preferences of people become more heterogeneous. Hence, economic gains from diversification of outputs in local jurisdictions emerge and thus possibly from fiscal decentralization.

2.2.5 Small size of the country

If a country and/or its population is relatively small, the individual views may be relatively homogeneous. Hence, differences in individual preferences for public goods and servcies may not be pronounced thus reducing the potential gains from decentralization. In addition, the fixed costs implied by decentralization may not warrant the effort to decentralize.

2.2.6 Scarcity of good local taxes

It is clear that decentralization requires own revenue sources for subnational governments. From the perspective of the expected benefits arising from competition and accountability of subnational governments these revenue sources should be determined by subnational governments. From the perspective of securing a "good" tax system that provides for equity, little distortions, low administrative costs, income elastic revenues etc. the revenue sources should be determined at the national level. As a compromise the traditional Musgrave (1959) view is still widely shared. This view holds that of the three main functions of a government (i.e. allocation, redistribution and stabilization) only the allocation

function may be shared by different levels of government; its financing should rely, to the extent possible, on the benefits-received principle in order to preserve fairness and economic efficiency. However, taxes, fees and surcharges that satisfy the benefits-received principle are relatively scarce, in general they do not yield sufficient revenue and their administration can be costly and difficult (Mc Lure, 1995; Tanzi 1995). Hence, revenue sharing is indispensable in financing subnational governments but this reduces the latter's fiscal autonomy, responsibility and accountability and has the mentioned drawbacks for stabilization.

2.2.7 Low degree of urbanization

The local governments of rural areas are faced with a little diversified tax base and democratic control may function less well there (Prud'homme, 1994). Hence, a rising degree of urbanization may facilitate decentralization and vice versa.

2.2.8 Scarcity of goods and services that are truly "public"

The idea of efficiency gains through fiscal decentralization is based on the assumption that a government needs to supply goods and services which are "public" (nonexcludable, nonrival). However, there are few goods and services that qualify for the strict definition of being public. In addition, their composition is subject to changes. Technical progress appears, on the one hand, to contribute to reducing the number of true public goods, for instance by facilitating excludibility in the use of public services such as roads. On the other hand, it needs to be recognized that technical progress may also contribute to increasing demand for public goods and services such as noise and pollution control and police protection (for instance in the internet). However, basic education and health care, waste disposal services, utilities, security, prisons etc. all could and sometimes are supplied by private companies. The activity of these private companies could be subject to governmental supervision to maintain minimum quality standards. Hence the question arises whether instead of decentralization a superior form of improving efficiency in supplying these goods and services could be simply to encourage their private supply. Equity aspects and positive

externalities could be considered by introducing vouchers, issued by the central government to consumers, that allow a minimum consumption per capita at no direct cost to the consumer (McLure, 1995). Consumers would use the vouchers for their basic needs and thus decide directly and not via the local democracy on the types and quality of services they want to consume. Equity and regional equalization aspects could be very well considered in this approach, especially when it would be combined with means testing.

However, there are also be drawbacks of this suggestion: it is the central government that would have to decide on the goods and services that can be obtained with the vouchers. But the central government is farther away from consumers than local governments. Misuse of the vouchers and difficulties with means testing are additional problems.

To sum up, important determinants of fiscal decentralization are[4]:

- The quality of central and of local government

  (The lower the quality on either level, the less attractive fiscal decentralization may be);

- The quality of local democracy;

- Income differentials between households and regions

  (The larger they are the more important becomes redistributional policy that can be implemented effectively only by the central government making fiscal decentralization less attractive);

- Per capita income

  (Fiscal decentralization may be less attractive for low income countries due to both fixed costs and relatively low and homogeneous demands for public goods and services);

- Size of the country

[4] Panizza (1999) tests for the sign and significance of some of these determinants of fiscal decentralization (income per capita, ethnic fractionalization, country size, and the level of democracy). Using different estimation methods and a relatively large set of countries, he finds for the period of about 1975 through 1985 that all these four determinants are postively correlated with fiscal decentralization.

(The smaller the size and population, the smaller the differences in preferences may tend to be, reducing the potential gains from decentralization);

- The degree of urbanization or local and regional differences in the diversification of tax bases

  (The more tax bases of regions and communities are diversified and the smaller the differences of this diversification between communities are, the more attractive fiscal decentralization may appear);

- Diversity of ethnic groups

  (If there is considerable ethnic fractionalization, fiscal decentralization may become attractive as a means for integration);

- Presence of true public goods and services

  (Goods and services supplied by governments that are not truly public could be produced under private competition; low income households could receive vouchers issued by the central government; thus fiscal decentralization may appear less attractive).

When theoretical considerations yield ambiguous results, empirical analysis becomes even more important. Given the vagueness of outcomes of theoretical analyses of fiscal decentralization, the case for and against it ultimately hinges on empirical evidence as to whether it promotes economic performance. However, as Oates (1995) notes, such empirical evidence is scarce. Oates (1995) claims, however, that his own empirical research for a group of 40 countries yielded a statistically significant and robust positive correlation between a measure of fiscal decentralisation (sub-national government's share of public expenditures) and per capita economic growth. He also claimed to have found a statistically significant positive relationship between the change of a measure of self-reliance of sub-national governments (own revenues of sub-national governments as a share of total revenues) and per capita economic growth. This would indicate that a movement toward

greater self-reliance of sub-national governments promotes economic performance.

3 Analytical background and estimation proceedings

3.1 Analytical background

3.1.1 Theoretical growth analysis

In traditional, neoclassical growth theory the steady-state economic growth rate is determined by the growth rate of the population (labor force) and technical progress, both of which are exogenously given. Growth is determined solely by the supply of factors and not influenced by macroeconomic policies. With the rise of the theoretical endogenous economic growth models (e.g. Romer, 1986, Grossman and Helpman, 1990, Villanueva, 1993) effects of economic policies on the growth process became explicitly recognized. In addition, human capital was introduced in the production function as a separate production factor. Consequently the growth accounting equation was modified to either include human capital separately or to replace raw labor by effective labor. With human capital counted separately, the growth accounting equation becomes:

$$(1) \qquad y = \beta_1 k + \beta_2 h + \beta_3 l + \beta_4 a ,$$

where y is the rate of growth of real GDP, k is the rate of growth of physical capital, h is the rate of growth of human capital, l is the rate of growth of raw labor, a is the rate of growth of overall efficiency in combining capital (physical and human) and raw labor, and β_i is the elasticity of economic growth with respect to argument i.

In endogenous growth models one or several of the right hand side variables in equation (1) are made dependent on one or several variable(s) of interest, including policy variables. Usually, the steady-state growth rate in these models depends positively on the variable(s) of interest. Thus, economic growth can be higher than in

traditional neoclassical growth models. The growth rate (and net return on capital) can be larger than the sum of the exogenous rates of population growth and technical progress. The capability of these theoretical models to account for the potentially powerful effects of government policies on economic growth inspired extensive empirical work on these effects. Yet, there is still no consensus theoretical model to guide empirical work on growth.

3.1.2 Empirical growth analysis

Two basic estimation approaches are employed in this empirical work: First, growth equations are specified such that in addition to the independent variables suggested by traditional neoclassical growth theory (i.e. initial per capita income level, population growth and the share of physical-investment in GDP) variables are included that represent human capital investment, government policies and political factors (e.g. Levine and Renelt, 1992; Barro and Sala-i-Martin, 1992; Knight et al., 1992, Barro 1997). Variables that represent government policies include the share of government consumption expenditures in GDP, measures of the degree of openness of the economy, of the level of public infrastructure, of macroeconomic stability (inflation, domestic credit growth, standard deviation of inflation and of domestic credit growth) etc. However, this approach is associated with interpretation difficulties, because it implicitly assumes that the independent variables included in the growth regression affect economic growth only through variables that are not included. For instance, when estimating a growth regression that includes measures for k, h and l in equation (1) and a variable that represents a particular macroeconomic policy, it is implicitly assumed that this variable does not affect economic growth through its impact on k, h, and l but solely through its impact on the productivity residual a. However, macroeconomic policies and fiscal decentralization affect growth in particular via investment in physical and human capital.[5]

[5] In fact, if it is assumed that population growth and growth of the labor force (variable l in equation 1) are determined mainly by non-economic factors and that physical and human capital incorporate all productive knowlegde so that exogenous technical progress (variable a in equation 1) becomes negligible, then differences of growth rates among countries need to be explained mainly with differences in investment.

A simple two step method that avoids this interpretation problem and allows identification of the channels through which macroeconomic policies affect economic growth was applied by Fischer (1993) on the basis of a proposal by Elias (1992): First, examine the relationships between growth and the policy variable(s) of interest. Second, examine the relationships between the change in both the supplies of production factors and the productivity residual, on the one hand, and the macroeconomic variables of interest, on the other[6].

In this paper, both approaches are used since the interpretation problem associated with the first approach may become less serious when additional evidence from the second approach is used.

3.1.3 Specific difficulties in examining potential growth effects of fiscal decentralization

Establishing a statistically significant link between fiscal decentralization and economic growth is associated with several problems. Four main ones are:

- A meaningful measure of fiscal decentralization needs to be constructed. According to the definition of decentralization adopted here, the share of expenditures of subnational governments in consolidated government expenditures appears to be reasonable indicator of decentralization. However, besides problems of missing data in IMF Government Finance statistics (even with regard to several advanced industrial countries) and of the relatively small length of available time series (they begin in the 1970s), there is the problem of data accuracy.
- The theoretical considerations above indicated that the relationship between fiscal decentralization and economic growth, if existing, may not be linear. Rather, it could be that "too little" fiscal decentralization is detrimental for long-term

[6] It has become popular in empirical studies whose goal is to measure the economic growth effect of a particular variable to concentrate on regressions where capital formation and factor productivity growth are the dependent variable. See, for instance, Holzmannn's analysis of the economic growth effects of the shift towards a capital-funds based pension system in Chile (1997).

economic growth: it provides too little incentives for subnational governments to improve allocative and productive efficiency so that the fixed costs it produces may become a net loss to society. On the other hand, if there is "too much" fiscal decentralization, a welfare loss could arise due to jeopardized stabilization, instability and greater inequities. This may also hamper economic growth in the long run. Hence, it may be hypothesized that there exists a hump shaped relationship between decentralization and economic performance such that a medium level of fiscal decentralization may best enhance the growth prospects. There is thus a need for testing for this nonlinear relationship[7].

- There is the difficulty of distinguishing effects of conditional convergence (i.e. countries with a relatively low initial income tend to have faster per capita growth than other countries after controlling for differences in saving rates -i.e. investment rates in a closed economy-, population growth, and technical progress) and endogenous growth effects such as the potential effect coming from fiscal decentralization.

- With regard to an empirical analysis of Western European countries, the fiscal powers of the supranational authority European Union need to be considered.[8] The budget of the EU and its legal powers regarding areas outside agriculture may be considered to be rather limited. However, there have been considerable grants and net transfers from the EU to a few member countries (with relatively low income in EU comparison). When estimating growth regressions for Western European countries the effects of these transfers should be controlled for.

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[7] Note that a hump-shaped relationship between the degree of the centralization of wage bargaining and real wages and unemployment (i.e. economic failure) was proposed by Calmfors and Driffill (1988). Their suggestion for how to test for a hump-shaped relationship is taken up below.

[8] As Oates (1993, p.8) put it: "What we seem to be observing is a .. complicated process with both decentralizing and centralizing forces at work, a process that is resulting, for example, in devolution in a number of OECD countries and at the same time in a new top layer of government in the European Community."

3.2 Estimation proceedings

3.2.1 Country sample

The sample includes 17 Western European countries (i.e. the member countries of the European Union plus Norway and Switzerland). However, to improve the statistical robustness 9 additional countries with a relatively large country size and different income levels are also included (table 1).

3.2.2 Indicators of fiscal decentralization

Several indicators of fiscal decentralization are employed. Since this study presents both pure cross-sectional regressions (using averages of the annual data covering the period 1975-95) as well as pooled cross-sectional (panel) regressions (covering the period 1981-95), there are two types of indicators: those which are available as time series can be used in both regressions. Those which are available only as period averages can be used in the pure cross-sectional regressions only.

The share of subnational government expenditures in consolidated government expenditures is the best known indicator of fiscal decentralization (indicator “A” in tables 1 and 2, denoted “IFDA” in the regressions). This indicator is available on an annual basis since about the 1970s, although surprisingly even for some advanced industrial countries there are considerable gaps (the appendix describes these gaps and the method used to fill some of them).

Regarding revenues, a measure of the self-reliance of subnational governments is used, i.e. own revenues of subnational governments as a share of their total revenues (denoted SR). The change of this indicator is also considered (denoted CHSR).

Two additional indicators of fiscal decentralization have been found in the political science literature (indicator B and C in table 1): These two indicators refer to about the past three decades and are not available as time series. Thus, they can be used only in pure cross-sectional regressions and not in panel regressions.

A fourth indicator was constructed to test for a non-linear (hump-shaped) relationship between economic performance and fiscal decentralization (denoted A' in tables 1 and 2 and IFDA' in the regressions): for the pure cross-sectional regressions this indicator was obtained by simply transforming the period averages of indicator A such that low and high values become low values whereas medium values of indicator A become high values (see table 2). In the pooled cross-sectional regressions non-linearities in the effects of fiscal decentralization on economic growth, capital formation and total factor productivity were estimated using a spline function of indicator IFDA. The function breaks at shares of 30 and 45 percent of subnational government expenditures in consolidated expenditures. The resulting three indicators are denoted FDL for "low degree of fiscal decentralization", FDM for "medium degree of fiscal decentralization", and FDH for "high degree of fiscal decentralization".

Table 1 presents correlation coefficients between the indicators A, B, C, and A' of the sample countries (i.e. indicators of the average degree of fiscal decentralization during the past three decades or so) on the one hand, and the per capita income level of 1998 (measured in US-Dollars) and the average real per capita growth rate during the past three decades, on the other hand. Fiscal decentralization, as measured by the indicators A, B and C, is positively correlated with the income level. (Note that in contrast to indicators A and B, indicator C rises with increasing centralization). A relatively high, positve correlation is found for Western Europe, especially if the tiny state Luxembourg is excluded that has a low degree of fiscal decentralization and the highest per capita income. Scandinavian countries have traditionally relatively far reaching political powers of local governments which is reflected in relatively high values of indicator A of fiscal decentralization. These countries are also among the wealthiest ones in Western Europe.

However, the correlation between the measures of fiscal decentralization (indicators A, B and C) and average per capita growth rates is negative for Western Europe while positive for other countries. Interestingly, the coefficient of correlation between fiscal decentralization and economic growth changes its sign for both

Western European countries and the small group of low income countries in the sample (which are middle income countries in world comparison) if indicator A is replaced by the transformed indicator A' (which rises with a movement from either a high or low degree of fiscal decentralization toward a medium degree).

These first impressions from table 1 suggest, first, that indeed the income level needs to be considered when examining growth effects of fiscal decentralization. Second, taken at face value, these simple correlation coefficients would suggest that middle income countries can reap more benefits from fiscal decentralization for their growth and income performance than high income countries. For high income countries the chances for economic growth may rise when moving from a low or high degree of fiscal decentralization towards a medium degree. Growth regressions may shed more light on these questions.

3.2.3 Specification

Limited specifications are used for both the pure cross-sectional growth regressions and the panel regressions so as to focus on a few key factors. Nevertheless, the specifications are consistent with a large assortment of endogenous growth models. The pure cross-sectional per capita growth regressions use a set of independent variables which are always included. These are the initial level of real GDP per capita in 1970 (RGDP70) from Summers, Kravis, Heston (1980) to consider the (conditional) convergence hypothesis, the average annual rate of population growth (GPOP), the average annual gross investment share of GDP (INVGDP), and the initial secondary-school enrollment rate in 1970 (SEC70) from Unesco as a proxy for the ratio of human capital investment to GDP[9].

Variables representing the degree of fiscal decentralization are the average annual indicator IFDA, its transformation IFDA' (to test for a hump-shaped relationship) and the indicators B and C from the

[9] In the estimations the initial school enrollment ratio was found to have a higher significance than the average school enrollment ratio over the considered period. This could be explained with lags between completion of education and its appropriate use as a production factor.

political science literature. These four variables are denoted FD variables and they are used as alternatives. Period averages of the annual values of the proxy for self-reliance of subnational governments (SR) and of the annual changes of this variable (CHSR) are included to test for Oates (1995, p. 353) hypothesis that increasing self-reliance promotes economic growth.

Also a dummy variable is included as a proxy for financial support granted by the European Union to the countries Greece, Ireland, Portugal and Spain (DEU4). These countries received substantial transfers from the European Union during the period considered and this may have influenced their economic growth. Finally, to consider the hypothesis that structural rigidities are pronounced in many countries so that domestic and/or external disturbances can have a relatively long lasting impact on economic growth, the average annual change in the unemployment rate (CHUER) is included as a proxy for such disturbances. In the very long run the impact of the change of the unemployment rate disappears, however. The estimated pure cross-sectional specification has thus the following general form:

$$(2) \quad GYP_i = \alpha + \beta_1 RGDP70_i + \beta_2 GPOP_i + \beta_3 INVGDP_i + \beta_4 SEC70_i + \beta_5 CHUER_i + \beta_6 DUE4_i + \beta_7 FD_i + \beta_8 SR_i + \beta_9 CHSR_i + \in_i ,$$

where GYP is the average annual growth rate of GDP per capita, FD is either IFDA, IFDA', B or C. The subscript i is indexing the country.

The equation was estimated using averages over the period 1975-95 for up to 26 countries. The expected signs of the estimated coefficients are as follows: β_1 is expected to be positive if there is evidence for conditional convergence (i.e. if countries with relatively low initial income tend to grow faster than other countries after controlling for differences in the rates of investment in physical and human capital, population growth and technical progress). The expected effect of population growth on per capita economic growth (β_2) is negative. The effects of investment in physical capital and of past investment in human capital (β_3 and β_4) are clearly positive. To

the extent that due to structural rigidities of the economies disturbances may have long lasting adverse effects on economic growth β_5 is expected to have a negative sign. β_6 is expected to be positive if this dummy coefficient captures the effect of grants from the EU and if these grants are used as intended, i.e. for improvements of the physical and institutional infrastructure of the recipient countries. Finally, the signs of major interest in this study β_7, β_8 and β_9 are not clear because theory suggests that fiscal decentralization may have a positive and negative influence on economic growth. In addition, it is not clear, a priori, whether there are nonlinear effects of fiscal decentralization.

Turning to the panel growth regressions, initial income is replaced by the real per capita growth rate of the previous year. However, in preliminary estimations this variable was generally not significant and its inclusion did not raise but lowered the explained variation of per capita growth. It was therefore dropped from most of the estimated panel equations. To account nevertheless for (conditional) convergence effects, a dummy variable was included for countries with relatively low income. In regressions with data for the Western European countries, a dummy is included for 5 countries with relatively low initial income, i.e. Greece, Ireland, Italy, Portugal, and Spain (denoted DEU5). Note, however, that four of these five countries, namely Greece, Ireland, Portugal, and Spain received substantial net transfers from the European Union during much of the considered time period and, thus, this dummy is likely to capture at least two effects: potential (conditional) convergence effects and effects of financial support granted by the European Union. In regressions with data for the full sample a dummy for European and non-European countries with relatively low initial income is included (denoted DLI)[10].

Preliminary estimations also showed that the gross investment share of GDP was insignificant and in some cases even had the wrong sign. Therefore, this indicator of physical investment was replaced

[10] These countries are: Greece, Ireland, Italy, Portugal, Spain, Argentina, Brazil, Korea, New Zealand, and South Africa.

by the growth rate of real gross fixed capital formation[11]. Also included in the panel regressions are the secondary school enrollment ratio as a proxy for investment in human capital (SEC), the change in the unemployment ratio as a proxy for macroeconomic disturbances, and, of course, measures of fiscal decentralization. The latter are the share of subnational government expenditures in consolidated expenditures (IFDA) and, as an alternative, the three categories of fiscal decentralization (low, medium and high fiscal decentralization) to test for nonlinear effects. In addition, the variables SR and CHSR are also included. The general form of the estimated panel regressions thus is:

$$
\begin{aligned}
(3) \qquad GYP_{i,t} = \; & \alpha + \beta_1 GYP_{i,t-1} + \beta_2 GPOP_{i,t} \\
& + \beta_3 GKAP_{i,t} + \beta_4 SEC_{i,t} + \beta_5 CHUER_{i,t} \\
& + \beta_6 \; DUE5_{i,t} + \beta_7 DLI_{i,t} + \beta_8 FD_{i,t} \\
& + \beta_9 SR_{i,t} + \beta_{10} CHSR_{i,t} + \in_{i,t},
\end{aligned}
$$

where GKAP is the annual growth rate of real gross fixed capital formation as an indicator of physical investment, SEC is the annual secondary scholl enrollment ratio, and DEU5 and DLI are dummy variables as explained above and used alternatingly. FD represents the indicators of fiscal decentralization, i.e. either the share of subnational government expenditures in consolidated government expenditures (IFDA), on the one hand, or the indicators FDL, FDM, and FDH to test for non-linear effects, on the other hand. The subscripts i and t are indexing the country and time period.

The equation was estimated for the period 1981 through 1995. The expected signs for β_1 and β_2 are negative, for β_3 and β_4, positive, for β_5, negative, and for β_6 and β_7, positive. The signs for β_8, β_9 and β_{10} are not clear a priori.

Based on the growth accounting framework two additional panel regressions were estimated to examine the channels through which fiscal decentralization may influence economic growth: First, capital

[11] Under the assumption that real capital stock depreciation is a relatively stable share of real gross investment, the latter is highly positively correlated with real net investment and thus also with the change in the real capital stock.

formation was examined and, second, total factor productivity growth (the Solow residual).

Capital formation is specified as a function of macroeconomic policy variables, including measures of fiscal decentralization, of macroeconomic disturbances (cyclical effects) and of a dummy variable to capture catch-up effects of countries with relatively low initial income. With regard to the four mentioned Western European countries with relatively low income that received considerable net transfers from the European Union, the dummy variable is likely, however, to not only capture convergence effects but also effects of grants from the European Union. Macroeconomic policy variables include the fiscal balance as a share of GDP (denoted FBGDP), the inflation rate (denoted GCPI), and uncertainty of economic agents with regard to macroeconomic stability, which is proxied by the standard deviation of dometic credit for overlapping five year periods (denoted STDDC)[12]. The employed measures of fiscal decentralization are the same as those used in the previous equation. Macroeconomic disturbances are proxied, as before, by the change in the unemployment rate (CHUER). Those regressions that are estimated with data for the Western European countries include a dummy variable for the four countries that received substantial grants from the European Union (DEU4). The regressions estimated with data for all sample countries include a dummy for countries with relatively low initial income (DLI). Thus, the estimated equations have the general form:

$$
\begin{aligned}
(4) \qquad GKAP_{i,t} = {} & \alpha + \beta_1 GKAP_{i,t-1} + \beta_2 FBGDP_{i,t} \\
& + \beta_3 GCPI_{i,t} + \beta_4 STDDC_{i,t} + \beta_5 CHUER_{i,t} \\
& + \beta_6 DUE4_{i,t} + \beta_7 DLI_{i,t} + \beta_8 FD_{i,t} \\
& + \beta_9 SR_{i,t} + \beta_{10} CHSR_{i,t} + \in_{i,t},
\end{aligned}
$$

where the dummy variables (DEU4 and DLI) are used alternatingly. As before, FD represents either the indicator IFDA or the indicators FDL, FDM, and FDH. The expected signs of the estimated coefficients are $\beta_1 > 0$, $\beta_2 > 0$ to the extent that the potential

[12] The standard deviation is calculated for overlapping five year periods where the last 4 years, the current year and the following year are considered.

crowding out effect of budget deficits prevails, β_3, β_4, and $\beta_5 < 0$, since inflation, uncertainty and disturbances are likely to inhibit capital formation, and β_6 and $\beta_7 > 0$, because of catch-up effects and due to the effects of the grants provided by the European Union. Again, the effects of the measures of fiscal decentralization β_8, β_9, and β_{10} are unclear.

Finally, panel equations are estimated to examine the relationship between fiscal decentralization and total factor productivity growth (RES). The latter was calculated for the sample countries as a Solow residual[13]. Independent variables included are the unemployment rate (UER), lagged one period, as a measure of cyclical effects on productivity growth, dummy variables for Western European countries and for other countries with relatively low income to capture potential catch-up effects and effects of European Union grants, and the indicators of fiscal decentralization. Hence, the general form of the estimated equations is:

$$(5) \quad RES_{i,t} = \alpha + \beta_1 RES_{i,t-1} + \beta_2 UER_{i,t-1} + \beta_3 DUE4_{i,t} + \beta_4 DLI_{i,t} + \beta_5 FD_{i,t} + \beta_6 SR_{i,t} + \beta_7 CHSR_{i,t} + \in_{i,t} .$$

The expected signs are $\beta_1 > 0$, $\beta_2 < 0$, β_3 and $\beta_4 > 0$. The signs of β_5 , β_6 and β_7 are unclear.

[13] Asuming a constant labor share of income of 0.65 the residuals were calculated as: $RES_{it} = GDPR_{it} - 0{,}35\ GKAP_{it} - 0{,}65\ GLAFO_{it}$, where GDPR is the growth rate of real GDP, GKAP is the growth rate of the real capital stock, and GLAFO is the growth rate of the labor force, i = 1, …26; t = 1981-1995. Note that the underlying assumptions of this procedure (constant factor shares, no consideration given to the quality of factor inputs etc.) are very restrictive, which is necessitated by data constraints.

4 Estimation results

4.1 Pure and pooled cross-sectional growth equations

Table 3 presents the pure cross-sectional regressions for the twenty year period 1975-1995. The variables that are always included in the regressions have in almost all cases the expected sign and are in general highly significant. There is strong evidence for (conditional) convergence since initial income (RGDP70) lowers the per capita economic growth rate. Investment in physical and human capital are positively related to per capita economic growth while population growth tends to lower per capita growth. This latter relationship is, however, not obtained in all estimated equations and thus ambiguous. The considered twenty year period was characterized by a trend rise of unemployment rates in many countries reflecting deep sitting structural rigidities. These have been costly in terms of per capita growth, as indicated by the estimated coefficients of the variable CHUER. The estimated coefficient of the dummy variable for four “low” income Western European countries (DEU4) is in most cases significant and positive. It suggests that even when controlling for convergence effects, per capita growth in these countries was on average almost half a percentage point higher than in the other Western European countries. Hence, it appears that EU grants to these countries indeed had a positive impact on growth.

In the pooled cross-sectional growth regressions presented in table 4 the initial income variable is replaced either by dummy variables for countries with relatively low income (DEU5 and DLI) or by the growth rate of real per capita GDP, lagged one period. In addition, the investment to GDP ratio is replaced by a proxy for the growth rate of the real capital stock, and the secondary school enrollment ratio of 1970 is replaced by the annual secondary school enrollment ratio. While the variables population growth and capital stock growth have the expected signs and are highly significant, the school enrollment variable is in all of the estimated panel equations (table 4) not significant and even has in some cases the unexpected negative sign. Apparently, the addition of the time series dimension to the cross-sectional dimension causes a break down of the

significance of this regressor. This result has been found also in other empirical growth studies (e.g. Knight et al., 1992). One major reason for this may be that there is a considerable time lag between accomplishment of school education and the contribution of educated labor to production and economic growth[14].

The variables of main interest in this study are the fiscal decentralization indicators. The share of subnational government expenditures in consolidated government expenditures (IFDA) is not significant in the growth regressions for European countries (equations 2a and 2d, table 3). However, this indicator is significant for the whole sample (equations 2g and 2j). But this significance disappears and the IFDA coefficient for European countries becomes even negative when adding the time series dimension in data, i.e. when estimating panel regressions (equations 3a and 3e, table 4)[15]. Apparently, the time series relation between fiscal decentralization as measured by indicator IFDA and growth (the effect of changes in the fiscal decentralization measure on growth within each country over time) was negative in Western Europe during the period considered.

The indicators B and C of fiscal decentralization from the political science literature can be used only in the pure cross-sectional regressions. They are significant only in the regressions with data for European countries (not shown in table 3) and they indicate that higher decentralization is associated with lower per capita growth in Western Europe. This corresponds to the negative, albeit insignificant, sign of the IFDA variable found in the panel regression 3a for Western European countries. So far then the impression is that at least for Western Europe the relationship between fiscal decentralization and economic growth may even be negative.

Substantial further insight can, however, be gained by testing for a nonlinear relationship between fiscal decentralization and economic growth. This requires use of the transformed indicator IFDA' instead

[14] Given that this study focuses on the relationship between fiscal decentralization and economic growth, no attempt has been made to redefine this proxy variable for human capital.

[15] Due to data constraints the pooled cross-sectional regressions presented in table 4 use the time period 1981 through 1995.

of indicator IFDA in the pure cross-sectional regressions. In the panel regressions the spline function of fiscal decentralization needs to be substituted for indicator IFDA (with fiscal decentralization broken into the three categories FDL, FDM, FDH).

Equations 2c and 2e, table 3, show that for Western European countries the indicator IFDA' is significant and positive, suggesting that indeed the relationship between fiscal decentralization and economic growth may not be linear. Rather, it appears that for Western European countries there is evidence supporting the hypothesis of a hump shaped relationship between per capita economic growth and fiscal decentralization. By contrast, when estimating pure cross-sectional regressions where all countries in the sample are included, the indicator IFDA' is barely significant but IFDA is (equations 2g and 2j in table 3 need to be compared with equations 2h and 2k). This suggests that for non-European countries in the sample there is a positive association between fiscal decentralization and per capita economic growth. The pooled cross-sectional regressions (table 4) confirm this: Equation 3c shows that for Western European countries the variable FDM (medium degree of fiscal decentralization) has a slightly larger estimated coefficient than the variables FDL (low degree of fiscal decentralization) and FDH (high degree of fiscal decentralization). In other words, in Western Europe, a medium degree of fiscal decentralization was associated with a slightly higher per capita growth rate than either a low degree or high degree of fiscal decentralization.

For the full sample it is found, however, that with an increasing degree of fiscal decentralization, the per capita growth rate tends to increase (equation 3f). Splitting the sample into one group that includes 9 countries with relatively low income and another group that includes 12 countries with relatively high income shows that these two country groups differ with regard to the existing relationship between fiscal decentralization and economic growth: For the country group with relatively low income the association between fiscal decentralization and growth strengthens substantially as fiscal decentralization rises (equation 3j, table 4). The higher the decentralization category, the higher becomes both the estimated coefficient and the significance. By contrast, for the country group

with relatively high income the medium category of fiscal decentralization (FDM) has both a larger estimated coefficient and higher significance than the other two categories (equation 3k, table 4).

Regarding the relationship between the measure of self-reliance of subnational governments (SR) and its change (CHSR), on the one hand, and economic growth, on the other hand, the evidence from pure cross-sectional regressions (table 3) suggests that both variables are even negatively related to economic growth. However, when adding the time series dimension to the pure cross-sectional dimension (table 4) the estimated coefficient of the change of the self-reliance variable (CHSR) becomes positive and in some cases significant (equations 3h and 3k, table 4). This finding provides support for Oates' (1995) claim that increasing self-reliance of subnational governments on own revenues is beneficial for economic growth.

However, these results do not yet shed light on the channels through which fiscal decentralization and increasing self-reliance of subnational governments may affect economic growth. This is discussed in the following two sections.

4.2 Capital formation panel equations

Table 5 shows the panel regressions of capital formation. Capital stock growth lagged one period (GKAP (-1)), the inflation rate (GCPI), the proxy for macroeconomic disturbances (CHUER) and the dummy variables (DEU4, DLI) all have the expected signs and are in general highly significant. Interestingly, the estimated coefficients of the variables fiscal balance as a share of GDP (FBGDP), inflation (GCPI), and macroeconomic uncertainty (STDDC), are larger and more significant for the group of relatively wealthy countries (equations 4a- 4c, and 4h) than for the group of countries with relatively low income (equation 4g).

The association between capital formation and fiscal decentralization is similar to the one between per capita growth and fiscal decentralization: For Western European and high income countries the relationship does not appear to be linear (the IFDA

variable is not significant). For Western European countries it is the medium category of fiscal decentralization that has the largest estimated coefficient (equations 4b and 4c), i.e. growth of the real capital stock tends to be larger in countries with a medium degree of fiscal decentralization than in countries with either a low or high degree of decentralization. Taken at face value the estimated coefficients of the fiscal decentralization variables FDL, FDM, and FDH for Western European countries suggest the following: After controlling for the influence on capital stock growth of macroeconomic policies (fiscal balance, inflation), of uncertainty and of macroeconomic disturbances, the capital stock grew at least 0.4 percentage points per year faster in countries with a medium degree of fiscal decentralization than in countries with either a low or high degree of decentralization. Given that the average annual growth of the estimated real capital stock for the 17 Western European countries during 1975-1995 was about 2.5 percent, this is a considerable difference. The finding that a medium degree of fiscal decentralization is associated with higher capital stock growth holds also for the group of 12 wealthiest countries in the sample (equation 4h). For these countries the estimation suggests that a medium degree of fiscal decentralization may raise annual capital stock growth by even more than 1 percentage point. By contrast, for the group of 9 countries in the sample with relatively low per capita income (equation 4g), the estimated coefficients of the three categories of fiscal decentralization and their significance increase with increasing decentralization.

Turning to the self-reliance indicators (SR and CHSR) table 5 shows that the signs are as expected but in most cases the indicators are not significant at the 5 percent level. However, in the regression for all countries for whom these data are available the change of the self-reliance ratio (CHSR) is significant at the 10 percent level (equations 4d and 4e). Overall, the evidence appears to support the hypothesis of a positive association between increasing self-reliance of subnational governments and capital formation.

These results provide explanations for the estimated relationships between per capita economic growth and fiscal decentralization discussed in the previous section: Increasing fiscal decentralization

in low income countries of the sample is on average statistically significantly associated with higher per capita economic growth through higher capital formation. With regard to high income countries and Western European countries the medium category of fiscal decentralization is estimated to have the largest positive impact on capital formation. Hence, the growth regressions for these countries showed that a medium degree of fiscal decentralization is associated with higher economic growth than either a low or high degree of fiscal decentralization.

4.3 Total factor productivity panel equations

Finally, the relationship between total factor productivity growth and fiscal decentralization is examined (table 6). Obtaining a satisfactory statistical fit proved to be difficult. The explained portion of the variation in total factor productivity growth is relatively low. However, the results confirm the impression gained in the previous estimations that the income level needs to be considered when examining the relationship between fiscal decentralization and economic performance: table 6 suggests that in the countries with relatively low income in the sample, the association between fiscal decentralization and growth of total factor productivity on average becomes stronger as fiscal decentralization increases (equation 5c). In other words, in these countries increasing fiscal decentralization is on average statistically significantly associated with higher total factor productivity growth. By contrast, regarding wealthy countries and the group of Western European countries the opposite is found, i.e. a lower degree of fiscal decentralization is associated with higher total factor productivity growth (equations 5a, 5b, and 5d).

Interestingly, in these regressions the dummy for the four Western European countries that received substantial net transfers from the European Union proved insignificant. This suggests that these transfers had little influence on total factor productivity growth. The growth promoting effect of these transfers was thus mainly the result of their positive influence on capital formation.

The self-reliance indicators (SR and CHSR) did not prove to be significant regressors in the total factor productivity growth

regressions. This would suggest that the positive association between increasing self-reliance of subnational governments and economic growth - which was found in the panel growth regressions – needs to be explained with the positive impact of increasing self-reliance on capital formation.

5 Concluding remarks

The foregoing empirical analysis suggests for high income countries, in particular Western European countries, a hump-shaped relation between per capita economic growth and capital formation, on the one hand, and fiscal decentralization, on the other hand. By contrast, for countries with middle income (low income countries in the sample), the association between fiscal decentralization and economic growth and its determinants (capital formation and total factor productivity growth) becomes stronger as fiscal decentralization increases. Regarding the relation between economic performance and reliance of subnational governments on own revenue sources (own taxes and shared taxes) to finance their expenditures, there is empirical evidence suggesting that capital formation is positively related to increasing self-reliance, thus confirming Oates (1995).

It must be emphasized that this evidence refers to a limited group of (non-transition) countries and to a certain time period. Thus, it can serve as an illustration only. This evidence may be discussed in light of the criteria for the choice of fiscal decentralization derived in the theoretical part of this paper in section 2. There it was argued that the following characteristics of a country would tend to make fiscal decentralization a less attractive option for policy makers:

- Fiscal decentralization causes fixed costs which may be viewed too high relative to its potential benefits particularly in low income countries.
- Relatively low and homogeneous demand for public goods.
- Poor quality of local government and of local democracy.
- Large income differentials between households and regions.

- Low degree of urbanization, i.e. little diversified tax bases in the regions.
- Relatively small size of a country and of its population.
- Little diversity of ethnic groups.
- Scarcity of true public goods and services.

For a high income country it could be expected that especially the first three criteria are less relevant. Assuming further that

- tax bases are relatively diversified in all regions of a high income country,
- that even when such a country has a relatively small size and population there are pronounced differences in the preferences of individuals and that
- the demand for public goods and services is relatively income elastic and high,

then there remains only one argument that could explain why such a high income country may wish to limit the degree of fiscal decentralization. This is the fourth argument, i.e. relatively large income differentials between households and regions that would emerge in the absence of redistributional policy. Since effective redistributional policy requires central government intervention this may be an important reason for a high income country with pronounced differences of individuals' tastes and preferences to limit the degree of fiscal decentralization. In fact, if unattended income differentials between households and regions may hinder long run economic growth and development. This line of reasoning could be a tentative explanation for a hump-shaped relationship between economic growth and capital formation, on the one hand, and fiscal decentralization, on the other, in high income countries.

With regard to middle income countries, those that were considered in this study do not have such relatively high degrees of fiscal decentralization as can be found in the group of high income countries. In other words, in the middle income countries that are considered in the sample the central government redistributes on average a somewhat larger share of consolidated government revenues than in the very high income countries. This needs to be considered when interpreting the above empirical finding that in

these countries an increasing degree of fiscal decentralization tends to be associated with higher capital formation and a better growth performance.

Another consideration is that at a somewhat lower stage of economic development the benefits of fiscal decentralization with respect to efficient public investment (in educational institutions, roads, utilities etc.) and efficient production of public goods and services could be more pronounced than at a later stage when major infrastructure projects are already completed. Under this assumption, a marginal increase in the degree of fiscal decentralization in a middle income country could yield higher benefits regarding economic growth than in an already highly developed country, especially if the degree of fiscal decentralization is not yet relatively high.

In sum, it could be argued that there are diminishing returns to fiscal decentralization which for middle income countries in the study did not yet set in so that for them a positive association between fiscal decentralization and economic growth results.

Appendix: Data sources for and definitions of indicators of fiscal decentralization

The share of subnational government expenditures in consolidated government expenditures (denoted indicator "A" in tables 1 and 2, and "IFDA" in tables 3-6 that show the regression results) was taken from the Government Finance Statistics Yearbook from the International Monetary Fund. The cross-sectional regressions use annual averages over the period 1975 through 1995. However, due to missing data the following shorter periods had to be used in constructing period averages for 4 Western European countries and 3 other countries: Belgium: 1978-95, Greece: 1972-81, Italy: 1985-89 and 1995; Portugal: 1975-77 and 1987-95; Korea: 1976-78, New Zealand: 1978-81 and 1992-95, Japan: 1972-74. For the panel regressions, which use the shorter period of 1981 through 1995, it appeared justifiable in the cases of Italy, Portugal, and New Zealand to construct the missing data: For Italy missing data for 1990-94 were constructed by assuming that the indicator evolves linearly from 1989 to 1995. For Portugal and New Zealand the missing years 1981-86 and 1982-91, respectively, were similarly constructed. In these three cases a relatively minor variation in the indicator values that sorround the missing years may justify the approach used here to fill data gaps. This procedure was, however, not deemed justifiable in the cases of Greece, Japan and Korea. Hence, for these countries the indicator IFDA is not available as a time series.

The indicator of self-reliance of subnational governments (i.e. own revenues of subnational governments as a share of their total revenues, denoted SR and its change, denoted CHSR) was also taken from the Government Finance Statistics Yearbook. The calculation of period averages of SR and of CHSR for use in the pure cross-sectional regressions was associated with the problem of missing data for the same countries and years that are mentioned in the previous paragraph with regard to indicator IFDA. For the panel regressions missing data points of SR and CHSR for Italy have been constructed using the approach described in the previous paragraph.

For other countries with data gaps this procedure did not appear to be justifiable. Consequently indicators SR and CHSR are not available as time series for Greece, Portugal, Japan, Korea and New Zealand.

To test for a non-linear relationship between fiscal decentralization and economic growth and its determinants in the pooled cross-sectional regressions a spline function of indicator IFDA was used. The function breaks at shares of 30 and 45 percent of subnational government expenditures in consolidated expenditures. The resulting three indicators are denoted FDL for “low degree of fiscal decentralization”, FDM for “medium degree of fiscal decentralization”, and FDH for “high degree of fiscal decentralization”. These indicators were constructed for all countries in the sample. For Greece, Italy, Portugal and New Zealand the available IFDA data are substantially below a 30% share of subnational government expenditures in total government expenditures. Therefore, years of missing data for these countries were classified as ones that fall in the category of a “low degree of fiscal decentralization (FDL)”. In the case of Japan it was assumed that the medium range of fiscal decentralization which prevailed in the beginning of the 1970s was maintained throughout the period under consideration. For Korea it was assumed that the relatively high degree of fiscal decentralization (according to the classification adopted here), which prevailed in the second half of the 1970s, was maintained.

References

Bahl, Roy W., and Johannes F. Linn (1992), Urban Public Finance in Developing Countries, New York;

Barro, Robert J., and Xavier Sala-I-Martin, (1992), "Convergence," Journal of Political Economy, Vol. 100, No. 2, April, pp. 223-251;

Barro, Robert, J. (1997), Determinants of Economic Growth: A Cross-Country Empirical Study, Cambridge, Mass.;

Bird, Richard (1994), "Decentralizing Infrastructure: For Good of For Ill?," World Bank Policy Research Working Paper, No. 1258, Washington D.C.;

Borjas, G. (1995), "Ethnicity, neighborhoods, and human capital externalities," American Economic Review, Vol. 85, pp. 365-390;

Brennan, G, and J. Buchanan (1980), The Power to Tax: Analytical Foundations of a Fiscal Constitution, Cambridge, U.K.;

Calmfors, Lars, and John Driffill (1988), "Bargaining structure, corporatism and macroeconomic performance," Economic Policy, Vol. 6, pp. 14- 61;

Elias, Victor J. (1992), Sources of Growth, San Francisco;

European Bank for Reconstruction and Development (1999), Transition Report 1999, London;

Fischer, Stanley (1993), "The Role of Macroeconomic Factors in Growth," National Bureauof Economic Research, Working Paper No. 4565, Cambridge, Mass., December;

Grossman, Gene, and Elhanan Helpman (1990), "Comparative Advantage and Lonrg-Run Growth," American Economic Review, Vol. 80, September, pp. 796-815;

Holzmann, Robert (1997), "Pension Reform, Financial Market Development, and Economic Growth: Preliminary Evidence from Chile," International Monetary Fund Staff Papers, Vol. 44, No. 2, Washington, D.C., pp. 149-178;

International Monetary Fund, Government Finance Statistics Yearbook, Washington, D.C., various issues;

International Monetary Fund, International Financial Statistics, Washington, D.C., various issues;

Knight, Malcolm, Norman Loayza, and Delano Villanueva, "Testing the Neoclassical Theory of Economic Growth: A Panel Data Approach," International Monetary Fund, Working Paper, Washington, D.C., December 1992;

Leijphart, Arend, Patterns of Democracy, Government Forms and Performance in Thirty-Six Countries

Levine, Ross, and David Renelt, "A Sensitivity Analysis of Cross-Country Grwoth Regressions," American Economic Review, Vol. 82, No. 4, September 1992, pp. 942-963;

McLure, Charles, Jr., (1995), "Comment on 'Fiscal Federalism and Decentralization: A Review of Some Efficiency and Macroeconomic Aspects,' by Vito Tanzi," in: Bruno, Michael, and Boris Pleskovic (editors), Annual World Bank Conference on Development Economics 1995, World Bank, Washington, D.C., pp. 317-322;

Musgrave, Richard A. (1959), The Theory of Public Finance, New York;

Oates, Wallace E. (1993), "Fiscal Decentralization and Economic Development," University of Maryland, Working Paper No. 93-4, May;

Oates, Wallace E. (1994), "The Potential and Perils of Fiscal Decentralization," University of Maryland;

Oates, Wallace E. (1995), "Comment on 'Conflicts and Dilemmas of Decentralization', by Rudolf Hommes," in: Bruno, Michael, and Boris Pleskovic (editors), Annual World Bank Conference on Development Economics 1995, World Bank, Washington, D.C., pp. 351-353;

Oates, Wallace E. (1977), "An Economist's Perspective on Fiscal Federalism," in: Wallace E. Oates (editor), The Political Economy of Fiscal Federalism, Lexington, Toronto, 1977, pp. 3-20;

Panizza, Ugo (1999), “On the determinants of fiscal centralization: Theory and evidence,” Journal of Public Economics, Vol. 74, pp. 97-139;

Prud’homme, Rémy (1994), “On the Dangers of Decentralization,” World Bank Policy Research Working Paper, No. 1252, Washington, D.C.;

Prud’homme, Rémy (1995), “Comment on ‘Conflicts and Dilemmas of Decentralization’ by Rudolf Hommes,” in: Bruno, Michael, and Boris Pleskovic (editors), Annual World Bank Conference on Development Economics 1995, World Bank, Washington, D.C., pp. 354-359;

Romer, Paul (186), “Increasing Returns and Long-Run Growth”, Journal of Political Economy, Vol. 94, October, pp. 1002-1037;

Summers, Robert, Irving B. Kravis, and Alan Heston (1980), “International Comparisons of Real Product And Its Composition: 1950-77,” Review of Income and Wealth, pp. 19-66;

Tanzi, Vito, (1995), “Fiscal Federalism and Decentralization: A Review of Some Efficiency and Macroeconomic Aspects,” in: Bruno, Michael, and Boris Pleskovic (editors), Annual World Bank Conference on Development Economics 1995, World Bank, Washington, D.C., pp. 295-316;

Tiebout, Charles M., (1956), “A pure theory of local expenditures,” Journal of Political Economy, Vol. 64, pp. 416-424;

United Nations, UNESCO, Statistical Yearbook, Paris, various issues;

Villanueva, Delano (1993), “Openness, Human Development, and Fiscal Policies: Effects on Economic Growth and Speed of Adjustment”, International Monetary Fund, Working Paper, Washington, D.C., July;

World Bank, World Development Indicators, Washington, D.C.;

Zhuravskaya, E. (1999), “Incentives to provide public goods: Fiscal federalism Russian style,” Journal of Public Economics;

Summary:

Following a brief review of the theoretical literature on the benefits and shortcomings of fiscal decentralization this paper presents an empirical analysis of the relationship between per capita economic growth and its production function determinants, on the one hand, and constructed indicators of fiscal decentralization, on the other hand. The analysis suggests for high income countries, in particular Western European countries, a hump-shaped relation between per capita economic growth and capital formation, on the one hand, and fiscal decentralization, on the other hand. By contrast, for countries with middle income, the association between fiscal decentralization and economic growth and its determinants (capital formation and total factor productivity growth) becomes stronger as fiscal decentralization increases.

Zusammenfassung:

Das Papier gibt zunächst einen Überblick über die theoretischen Argumente für und gegen fiskalische Dezentralisierung. Für westeuropäische Länder sowie ausgewählte weitere Länder mit mittlerem Einkommensniveau wird dann eine empirische Analyse des Zusammenhangs zwischen Indikatoren des fiskalischen Dezentralisierungsgrades und dem wirtschaftlichen Wachstum durchgeführt. Als abhängige Variable in den Regressionen wird aber nicht nur das Wirtschaftswachstum berücksichtigt, sondern auch zwei Komponenten des Wirtschaftswachstums, nämlich Kapitalbildung und Wachstum der totalen Faktorproduktivität. Die Ergebnisse sind, daß für Länder mit hohem Einkommen und westeuropäische Länder kein linearer Zusammenhang zwischen Wirtschaftswachstum und seinen Komponenten -auf der einen Seite- und fiskalischer Dezentralisierung -auf der anderen Seite- zu bestehen scheint. Vielmehr scheint dieser Zusammenhang “glockenförmig” zu sein. Dagegen gilt für die Länder mit relativ niedrigem Einkommensniveau der Stichprobe (dies sind Länder mit mittlerem Einkommensniveau nach der Klassifizierung der Weltbank), daß zunehmende fiskalische Dezentralisierung mit steigendem pro-Kopf Wirtschafswachstum und höherer Kapitalbildung verbunden ist.

Table 1
Income level, growth performance, and fiscal decentralization of Western European and selected other countries

Country	Income level (GNP per capita in US-Dollars 1998)	Growth performance during 1970-1998 (average annual growth rate of real per capita GDP)	Indicator A of fiscal decentralization 1)	Indicator B of fiscal decentralization 2)	Indicator C of fiscal decentralization 3)	Indicator A' of fiscal decentralization 4)	Correlation coefficients: Correlation between the income level and the indicators of fiscal decentralization: Indicator A	Indicator B	Indicator C	Indicator A'	Correlation between growth performance and the indicators of fiscal decentralization: Indicator A	Indicator B	Indicator C	Indicator A'
Western European countries:							1	0	-0.28	0	-0.38 4)	-0.42	0.46	0
Luxembourg	43386 5)	2,07	16,5	1,0	0.79	9	excluding							
Switzerland	40080	1,25	58.2	5,0	-1.53	3	Luxembourg:							
Norway	34330	3,05	38,0	2,0	-0.08	23	1	1	-0.48	0	-0.42 4)	-0.46	1	0
Denmark	33260	2,01	56.9	2,0	0.49	5								
Austria	26850	2,61	33.5	4,5	-0.37	26								
Germany	25850	1,64	46,2	5,0	-1,79	11								
Sweden	25620	1,54	42,3	2,0	-0,06	15								
Belgium	25380	2,26	12,8	3,2	0,19	7								
France	24940	2,06	17,9	1,3	0,36	11								
Netherlands	24760	2,70	31,1	3,0	0,33	23								
Finland	24110 6)	2,58	44,3	2,0	0,46	13								
United Kingdom	21400	2,07	29,3	1,0	1,40	17								
Italy	20250	2,27	26,4	1,5	0,01	15								
Ireland	18340	3,95 7)	30,0	1,0	0,76	21								
Spain	14080	2,47 7)	23,0	3,0	-0,23	13								
Greece	11650	2,24 7)8)	4,2	1,0	0,64	1								
Portugal	10690	3,49 7)	8,4	1,0	0,61	3								
Other selected high income countries:							0	0	-0.70	1	0	0	-0.74	1
Japan	32380	2,97	40,5	2,0	-1,11	19								
USA	29340	2,03	50,9	5,0	-1,62	7								
Australia	20300	1,95	50,2	5,0	-0,99	9								
Canada	20020	2,00	68,5	5,0	-1,22	1								
New Zealand	14700	1,07	11,3	1,0	2,16	5								
Selected relatively advanced middle income countries:							1	-	-	0	1	-	-	-0.56
Argentina	8970	0,89	37,3	-	-	26								
Korea, Rep.	7970	5,92	41,8	-	-	17								
Brazil	4570	2,50	38,3	-	-	21								
South Africa	2880	0,02	30,0	-	-	19								

1) Average share of government expenditures of lower levels of government in total government expenditures during 1975 through 1995,
The following shorter periods had to be used for countries whose data are insufficient:
Belgium: 1978-95, Greece: 1972-81, Italy: 1985-89, Portugal: 1987-95, Korea: 1976-78, New Zealand: 1978-81 and 1992-98, Brazil: 1975-94, Japan: 1972-74,
2) Classification on the basis of the political organisation in which the activities of government are divided between regional governments and the central one. The index rises with increasing fiscal decentralization.
The classification is based on an analysis of the period 1971-1996. See: Arend Lijphart, Patterns of Democracy, Government Forms and Perfomance in Thirty-Six Countries, New Haven and London 1999, p. 313.
3) Classification on the basis of the political and democratic organisation of the country. Note: Contrary to indicators A and B this indicator rises with increasing centralisation!
See: Manfred Schmidt, Demokratietheorien, Opladen, 1997, p, 245.
4) Indicator A adjusted so that medium values of fiscal decentralization are transformed into high values whereas low and high values of fiscal decentralization are transformed into low values. See table 3 for further explanations.
5) 1996.
6) During 1990-1993 Finland experienced a deep recession costing almost 10 percent of GDP. It was mainly caused by external shocks. Eliminating this effect and raising Finland's income accordingly, Finland's rank on this income scale would rise by about 5 places. Hence, without the recession the country's income level would continue to be very close to the other Scandinavian countries. Traditionally, this country group is characterised by a relatively high degree of fiscal decentralisation.
7) During the time period considered, several peripheral countries of the European Union (EU) received substantial net transfers from the EU. Since these transfers have been used to a large extent for infrastructure investment and adaptation of the recipient countries' institutional structure to EU standards they are likely to have had a positive impact on economic growth. Using the data provided by the Government Finance Statistics Yearbook of the IMF, these transfers have been particularly large in the cases of Ireland and Portugal. For instance, during the first half of the 1990s these two countries received annual average net transfers from the EU of about 1 percent and 1.8 percent of their GDP, respectively. According to other sources Ireland received annual net transfers from the EU of up to 7 percent of its GNP in the early 1990s. The positive impact of the transfers on economic growth needs to be considered in a comparison of growth rates of Western European countries. Without this impact the GDP growth rates of the recipient countries may have been lower.
8) Per capita growth of GNP since GDP series are not available over the entire period.
Sources: Income level: World Bank, World Development Report 1999/2000 and World Development Indicators; Growth performance: International Financial Statistics, International Monetary Fund.
Indicators of fiscal decentralization:
Indicators of fiscal decentralization: Indicator A: Calculated from Government Finance Statistics Yearbook, International Monetary Fund.
Indicator B: Arend Lijphart, Patterns of Democracy, Government Forms and Perfomance in Thirty-Six Countries, New Haven and London 1999, p. 313.
Indicator C: Manfred Schmidt, Demokratietheorien, Opladen, 1997, p, 245.

Table 2
Derivation of indicator A' of fiscal decentralization to test for a nonlinear relationship (a hump shaped relation) between economic growth and the degree of fiscal decentralization

	Indicator A	Ranking	Indicator A' 1)
Canada	0,684	1	1
Switzerland	0,582	2	3
Denmark	0,569	3	5
United States	0,509	4	7
Australia	0,502	5	9
Germany	0,462	6	11
Finland	0,443	7	13
Sweden	0,423	8	15
Korea	0,418	9	17
Japan	0,405	10	19
Brazil	0,383	11	21
Norway	0,380	12	23
Argentina	0,373	13	26
Austria	0,335	14	26
Netherlands	0,311	15	23
Ireland	0,300	16	21
South Africa	0,299	17	19
United Kingdom	0,293	18	17
Italy	0,257	19	15
Spain	0,230	20	13
France	0,179	21	11
Luxembourg	0,165	22	9
Belgium	0,128	23	7
New Zealand	0,112	24	5
Portugal	0,084	25	3
Greece	0,042	26	1

1) Starting with the lowest and highest values of indicator A these are given a value of one. The next lowest and highest values of indicator A are given higher values and this procedure is continued up to the medium range values of indicator A which receive the highest values.
This transformation of indicator A allows to test for a hump shaped relationship between economic growth and fiscal decentralization, i.e. whether a medium degree of fiscal decentralization is more likely to be positively related to economic growth than either a relatively low or high degree.
Source: Own calculation.

Table 3
Cross-sectional growth regressions:
Dependent variable: Average annual growth rate of real GDP per capita during 1975 through 1995 1)

Equation	Constant	RGDP70	GPOP	INVGDP	SEC70	CHUER	DEU4	IFDA	IFDA'	SR	CHSR	R^2 adjusted	F-statistic	Number of observations
17 Western European countries:														
(2a)		-0.022	-0,32	0,08	0,02	-0,01	0,005					0,99	12056,0	17
		(-2.37)*	(-3.88)*	(4.50)*	(4.65)*	(-5.39)*	(4.09)*							
(2b)		-0.021	-0,35	0,09	0,01	-0,01	0,004	0,004				0,99	9432,2	17
		(-2.17)'	(-3.91)*	(3.80)*	(1.42)	(-5.41)*	(2.75)*	(0.90)						
(2c)		-0.023	-0,21	0,07	0,01	-0,01	0,004		0,03			0,99	411,9	17
		(-1.83)'	(-2.22)'	(3.38)*	(2.24)*	(-4.34)*	(2.18)'		(4.42)*					
(2d)		-0.018	-0,16	0,10	0,01	-0,01	0,004	0,006		-0.012	-0,10	1,00	5918916	17
		(-2.13)'	(-1.42)	(5.39)*	(1.51)	(-6.22)*	(2.34)*	(0.96)		(-2.75)*	(-2.86)*			
(2e)		-0.015	0,04	0,09	0,01	-0,007	0,003		0,02	-0.014	-0,06	0,98	116,1	17
		(-2.07)'	(0.28)	(7.13)*	(2.37)*	(-5.16)*	(1.80)		(2.82)*	(-3.42)*	(-1.83)			
25 countries 2):														
(2f)		-0.037	-0,30	0,13	0,01	-0,02						0,99	430,5	25
		(-4.93)*	(-2.89)*	(10.86)*	(3.14)*	(-4.84)*								
(2g)	-0,007	-0.038	-0,005	0,17	0,01	-0,01		0,015		-0,02	-0,25	0,99	548,7	25
	(-2.12)'	(-4.86)*	(-0.04)	(11.54)*	(3.71)*	(-9.21)*		(6.71)*		(-7.80)*	(-5.55)*			
(2h)	-0,019	-0.020	0,254	0,20	0,02	-0,01			0,018	-0,02	-0,24	0,99	412,6	25
	(-3.34)*	(-2.56)*	(2.68)*	(9.28)*	(8.10)*	(-6.74)*			(1.97)'	(-7.38)*	(-4.95)*			
All 26 countries:														
(2i)	-0,018	-0.036	-0,52	0,18	0,01							0,99	2224,3	26
	(-4.28)*	(-5.24)*	(-4.54)*	(12.52)*	(3.27)*									
(2j)	-0,02	-0.02	-0,34	0,21	0,02			0,012		-0,02	-0,15	0,99	255,0	26
	(-4.72)*	(-2.56)*	(-1.47)	(11.45)*	(2.89)*			(5.74)*		(-6.16)*	(-6.07)*			
(2k)	-0,028	-0.041	-0,19	0,21	0,02				0,01	-0,02	-0,15	1,00	11927,8	26
	(-4.81)*	(-0.54)	(-1.01)	(10.0)*	(5.20)*				(1.44)	(-4.82)*	(-3.22)*			

1) Variable definitions are:
RGDP70: Real income in 1970 from the Summers, Kravis, Heston (1980) income table; DEU4: Dummy variable for four European countries that received considerable net transfers from the European Union which may have influenced their growth rate, i.e. Greece, Ireland, Portugal and Spain.
GPOP: Average annual growth rate of the population during 1995-95; INVGDP: Average annual share of gross investment in GDP during 1975-95;
SEC70: Secondary school enrollment ratio in 1970; SEC: Average school enrollment ratio during 1975-95;
CHUER: Average annual change of the unemployment rate during 1975-95; IFDA: Indicator of fiscal decentralization A from table 2;
IFDA': Indicator of fiscal decentralization A' from table 2; SR: Self-reliance ratio: Average share of own revenues of lower levels of government in their total revenues during the period 1975-95; CHSR: Average change of the self-reliance ratio during 1975-95.
2) All countries listed in table 2 excluding South Africa due to missing unemployment data.
Note: GLS method (with cross section weights) is used. T-statistics in parentheses; * indicates significance of the respective variable at the 95 percent probability level or higher.
' indicates significance at the 90 to 95 percent probability level.
Source: Own calculations.

Table 4
Pooled cross-sectional growth regressions:
Dependent variable: Annual growth rate of real GDP per capita 1)

							Dummy variables		Fiscal decentralization variables								Number of
Equation	Constant	GDPR(-1)	GPOP	GKAP	SEC	CHUER	DEU5	DLI	IFDA	FDL	FDM	FDH	SR	CHSR	R^2 adjusted	F-statistic	observations
16 Western European countries (Europe 17 excluding Greece):																	
(3a)	0,02		-0,60	0,13	0,002	-0,004	0,005		-0,006						0,70	96,1	241
	(3.04)*		(-15.68)*	(10.59)*	(0.48)	(-4.70)*	(2.52)*		(-0.89)								
17 Western European countries:																	
(3b)	0,016		-0,59	0,11	0,001	-0,005	0,004								0,69	113,6	255
	(3.13)*		(-15.14)*	(10.11)*	(0.24)	(-6.08)*	(2.53)*										
(3c)			-0.59	0,11	-0.001	-0,005	0,004			0,017	0,018	0,013			0,70	84,0	255
			(-16.74)*	(10.09)*	(-0.18)	(-5.99)*	(1.81)'			(3.25)*	(3.13)*	(2.38)*					
15 Western European countries (Europe 17 excluding Greece and Portugal):																	
(3d)			-0.61	0,14	-0.001	-0,004	0,005			0,018	0,018	0,014	-0,001	0,04	0,72	67,0	234
			(-17.40)*	(10.60)*	(-0.21)	(-4.13)*	(2.44)*			(2.60)*	(2.37)*	(1.78)'	(-0.14)	(1.62)			
22 countries (full sample from table 2 except Greece, Japan, Korea, South Africa):																	
(3e)	0,015		-0,61	0,14	0,003	-0,006		0,003	0,002						0,69	125,1	331
	(2.99)*		(-16.49)*	(12.42)*	(0.60)	(-6.81)*		(1.77)'	(0.41)								
25 countries (full sample except South Africa):																	
(3f)			-0,60	0,13	0,003	-0,007		0,006		0,0134	0,0158	0,0163			0,66	103,3	375
			(-15.67)*	(11.94)*	(0.74)	(-7.79)*		(2.87)*		(2.81)*	(3.32)*	(3.58)*					
26 countries (full sample):																	
(3g)			-0,67	0,18	0,003			0,003		0,012	0,013	0,015			0,63	111,9	390
			(-14.66)*	(20.80)*	(0.62)			(1.79)'		(2.56)*	(2.65)*	(3.07)*					
21 countries (full sample except Greece, Portugal, Japan, Korea, South Africa):																	
(3h)			-0,61	0,14	-0.0001	-0,005		-0,004		0,020	0,022	0,021	-0,006	0,05	0,83	168,0	312
			(-18.08)*	(13.39)*	(-0.02)	(-6.28)*		(-1.87)'		(3.55)*	(3.56)*	(3.49)*	(-1.37)	(2.24)*			
6 non-European countries (Australia, Canada, USA, Argentina, Brazil, South Africa):																	
(3i)			-1.32	0,20	0,025					0,014	0,038	0,021	-0.026	0,06	0,57	18,2	93
			(-4.09)*	(7.94)*	(1.39)					(0.76)	(2.19)*	(1.14)	(-1.38)	(0.56)			
9 countries with relatively "low" per capita income (Greece, Ireland, Portugal, Spain, Argentina, Brazil, Korea, South Africa):																	
(3j)		0.07	-1.50	0,13	-0.004					0,026	0,031	0,063			0,71	56,3	135
		(1.19)	(-7.46)*	(8.51)*	(-0.43)					(3.04)*	(3.31)*	(5.87)*					
12 countries with highest per capita income 2):																	
(3k)		-0.10	-0.55	0,1	-0.004	-0.009				0,021	0,024	0,021	0,0006	0,11	0,72	51,9	180
		(-2.11)*	(-14.36)*	(6.18)*	(-0.48)	(-5.86)*				(2.19)*	(2.32)*	(2.05)*	(0.08)	(2.26)*			

1) Annual data for the period 1981 through 1995 using 17 Western European countries and 9 other countries.
Variable definitions: GDPR(-1): Per capita real GDP growth rate lagged one period; GPOP: Growth rate of the population;
GKAP: Growth rate of real gross fixed capital formation used as a proxy for growth of the real capital stock:
Gross fixed capital formation is deflated using the producer price index, or, if not available, the CPI, in order to obtain real gross investment.
Under the assumption that real capital stock depreciation is a relatively stable share of real gross investment, the latter is highly positively correlated with real net investment and thus also with the change of the real capital stock, since real net investment equals the change in the real capital stock.
SEC: Annual secondary school enrollment ratio; CHUER: Annual change of the unemployment rate;
DEU5 and DLI are dummies to consider the "convergence" hypothesis:
DEU5: Dummy for five European countries wih relatively "low" initial income, i.e. Greece, Ireland, Portugal, Spain and Italy;
DLI: Dummy for European and non-European countries with relatively low "initial" income, i.e. Greece, Ireland, Italy, Portugal, Spain, Argentina, Brazil, Korea, New Zealand, South Africa.
IFDA: Indicator of fiscal decentralization, see footnote 1, table 2.
IFDL, IFDM, IFDH are indicators of fiscal decentralization which allow to test for non-linear effects of fiscal decentralization using a spline function.
The function breaks at the values 0.3 and 0.45 of indicator A in table 2:
FDL ("low fiscal decentralization") is the value of fiscal decentralization when indicator A is 30 percent or less,
FDM ("medium fiscal decentralization") is the value of fiscal decentralization when indicator A is between 30 and 45 percent.
FDH ("high fiscal decentralization") is the value of fiscal decentralization when indicator A is above 45 percent.
SR: Self-reliance ratio of lower levels of government, measured by the share of their own revenues relative to their total revenues; CHSR: Change of the self-reliance ratio.
Note: GLS method is used (cross section weights). T-statistics in parentheses; * indicates significance of the respective variable at the 95 percent probability level or higher;
' indicates significance at the 90 to 95 percent probability level.
The countries considered are those shown in tables 1 and 2 with the following exceptions due to insufficient data:
IFDA could not be constructed for Greece, Japan and Korea; CHUER is missing for South Africa; SR and CHSR are not available for Greece, Portugal, Japan, Korea, New Zealand.
2) Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland, USA.
Source: Own calculations.

Table 5
Pooled cross-sectional regressions: Capital formation as a function of macroeconomic policy variables and external factors 1)

Equation	Constant	GKAP(-1)	FBGDP	GCPI	STDDC	CHUER	DEU4	DLI	IFDA	FDL	FDM	FDH	SR	CHSR	R^2 adjusted	F-statistic	Number of observations
16 Western European countries:																	
(4a)	0,063	0,19	0,15	-0.41	-0.09	-0.04	0,04		-0.01						0,56	45,4	241
	(4.75)*	(3.70)*	(1.45)	(-4.45)*	(-2.12)*	(-10.45)*	(3.60)*		(-0.46)								
17 Western European countries:																	
(4b)		0,17	0,17	-0.34	-0,08	-0.04	0,05			0,055	0,06	0,052			0,54	38,7	255
		(3.22)*	(1.58)	(-3.41)*	(-2.04)*	(-10.78)*	(4.08)*			(6.01)*	(7.03)*	(5.78)*					
15 Western European countries (excluding Greece and Portugal):																	
(4c)		0,18	0,22	-0.48	-0.05	-0.04	0,04			0,041	0,045	0,031	0,35	0,16	0,61	36,3	229
		(3.45)*	(1.90)'	(-5.60)*	(-1.33)	(-10.4)*	(3.32)*			(2.64)*	(2.50)*	(1.64)	(1.51)	(1.64)			
21 countries (full sample except Greece, Portugal, Korea, Japan and New Zealand):																	
(4d)		0,15	0,063	-0.008	0,002	-0.04'		0,027	0,007				0,044	0,19	0,51	40,7	307
		(3.12)*	(0.67)	(-2.68)*	(0.42)	(-12.93)*		(2.47)*	(0.31)				(2.98)*	(1.88)'			
21 countries (full sample except Greece, Portugal, Korea, Japan and New Zealand):																	
(4e)		0,138	0,16	-0.008	0,002	-0.042		0,024		0,021	0,029	0,021	0,018	0,19	0,510	32,9	307
		(2.97)*	(1.56)	(-2.64)*	(0.42)	(-12.94)*		(2.18)*		(1.57)	(1.77)'	(1.29)	(0.82)	(1.89)'			
26 countries (full sample):																	
(4f)		0,4	0,13	-0.01	0,003			0,015		0,014	0,026	0,023			0,23	17,6	390
		(8.93)*	(1.37)	(-2.84)*	(0.89)			(1.48)		(1.64)	(3.49)*	(3.34)*					
9 countries with relatively "low" income (Greece, Ireland, Portugal, Spain, Argentina, Brazil, Korea, New Zealand, South Africa):																	
(4g)		0,3	0,0003	-0.01	0,004					0,014	0,029	0,098			0,27	9,2	135
		(3.92)*	(0.001)	(-3.22)*	(1.07)					(0.85)	(1.23)	(4.43)*					
12 countries with highest per capita income 2):																	
(4h)		0,16	0,2	-0.45	-0.07	-0.044				0,048	0,061	0,048	0,012	0,27	0,58	28,5	180
		(2.64)*	(1.69)'	(-3.61)*	(-1.48)	(-10.00)*				(2.27)*	(2.52)*	(2.01)*	(0.41)	(1.26)			

1) Dependent variable: GKAP, proxy for the growth rate of the real capital stock; see table 4. FBGDP: Fiscal balance as a share of GDP. GKAP(-1): Proxy for the growth rate of the real capital stock lagged one period; GCPI: Inflation (growth rate of the CPI); STDDC: Standard deviation of domestic credit growth as a proxy for uncertainty of financial variables on the part of economic agents. The standard deviation is calculated for overlapping five year periods where the last 4 years, the current year and the following year are considered; other variable definitions: see tables 3 and 4.
Note: GLS method is applied (with cross section weights) using annual data for the period 1981 through 1995 for the same countries as explained in table 4.
T-statistics in parentheses; * indicates significance of the respective variable at the 95 percent probability level or higher;
' indicates significance at the 90 to 95 percent probability level.
2) Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Norway, Sweden, Switzerland, USA. (Japan excluded due to missing data).
Source: Own calculations.

Table 6
Pooled cross-sectional regressions: Total factor productivity growth and fiscal decentralization 1)

Equation	RES (-1)	UER (-1)	DE4	FDL	FDM	FDH	SR	CHSR	R^2 adjusted	F-statistic	Number of observations
17 Western European countries:											
(5a)	0.3	-0.0008		0.016	0.012	0.003			0.18	14,8	255
	(5.18)*	(-2.86)*		(4.99)*	(4.01)*	(0.97)					
15 Western European countries:											
(5b)	0.34	-0.0008		0.016	0.011	0.003	-3.3 E-05	-0.007	0.25	13,3	229
	(5.96)*	(-3.21)*		(3.59)*	(2.27)*	(0.55)	(-0.005)	(-0.24)			
8 countries with relatively "low" income (Greece, Ireland, Portugal, Spain, Argentina, Brazil, Korea):											
(5c)	0.12	-0.001	0.016	0.005	0.011	0.018			0.1	3,6	121
	(1.39)	(-2.97)*	(2.28)*	(0.85)	(1.51)*	(2.46)*					
15 countries with highest per capita income 2):											
(5d)	0.29	0.0003		0.011	0.006	0.003			0.14	10,2	225
	(4.66)*	(-0.71)		(2.62)*	(2.33)*	(0.98)					

1) Total factor productivity is the Solow residual (RES). Due to data constraints it is calculated assuming a constant labour share of 0.65, i.e.: $RES_{it} = GDPR_{it} - 0.35\ GRKAP_{it} - 0.65\ GLAFO_{it}$, where GLAFO is the growth rate of the labour force, i = 1, …26; t = 1981-1995.

2) Austria, Belgium, Denmark, Finland, France, Germany, Italy, Japan, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom, USA.

Note: GLS method is applied (with cross section weights) using annual data for the period 1981 through 1995 for the same countries as explai in table 5, footnote 1). T-statistics in parentheses; * indicates significance of the respective variable at the 95 percent probability level or higher ' indicates significance at the 90 to 95 percent probability level.

Source: Own calculations.